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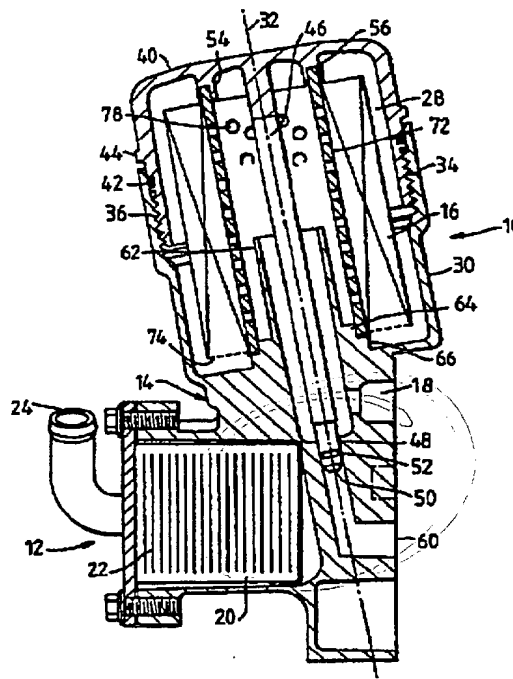
INT CL⁶ B01D 35/147 35/153 , F01M 1/10 11/03

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(54) Oil filter assembly

(57) A filter assembly for an I.C. engine comprises a filter housing (30) including a drain port (60) and a first threaded engaging surface (34); and an end cap (40) including a second threaded engaging surface (36) engageable with the first threaded engaging surface (34) so as to secure the end cap (40) to the filter housing (30) and an elongate spigot (46). When the end cap (40) is secured to the filter housing (30), the spigot (46) closes the drain port (60). A filter element (16) is provided which includes a filter medium and a central support tube (72) for supporting the filter medium within the filter housing (30), the support tube (72) being operative to close a second drain port in the filter housing. The support tube (72) is an interference fit on a support wall (54) in the end cap (40) so that the filter element (16) can be carried in the end cap (40).

Fig. 1.



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Fig. 1.

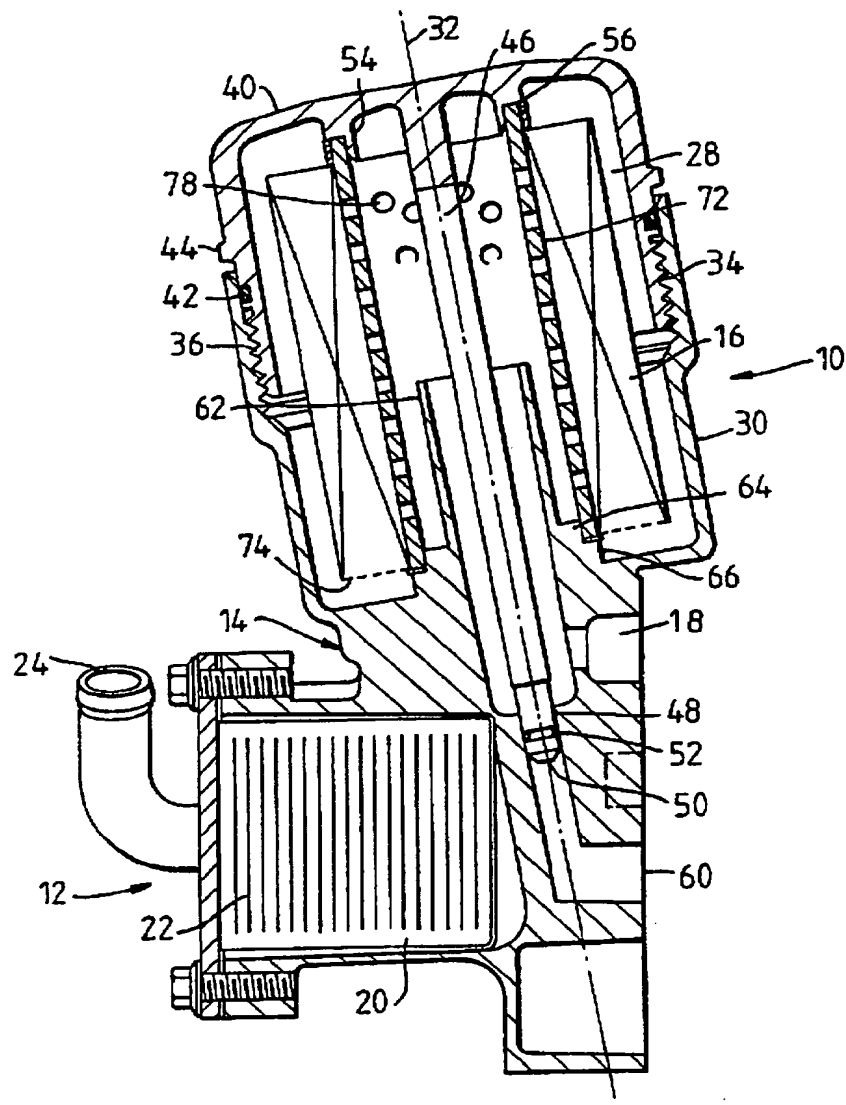
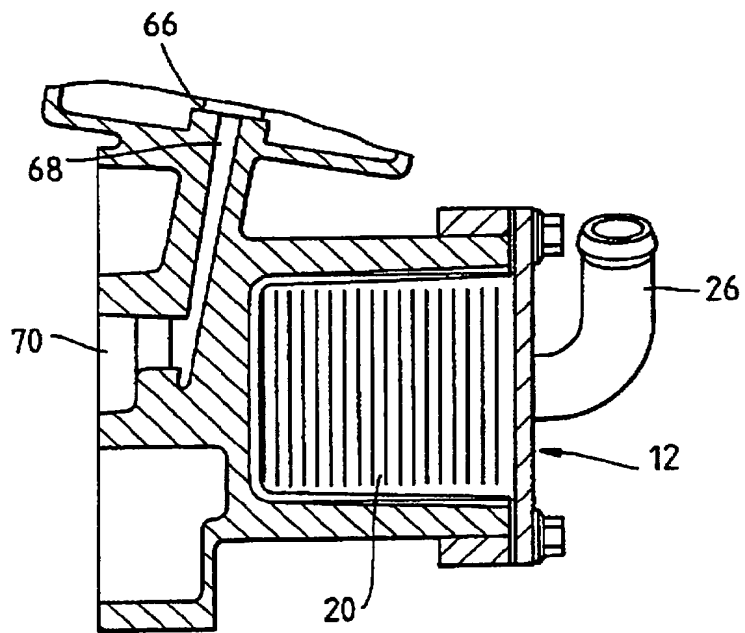


Fig. 2.

FILTER ASSEMBLY

The present invention relates to a filter assembly.

A known type of filter assembly for filtering oil in a motor vehicle comprises a filter housing having an aperture generally disposed above the main portion of the housing. A filter element fits within the housing, which is closed by means of a cap which seals the aperture. Oil to be filtered is fed through one or more inlet ports located in a lower part of the housing and below the filter element. After filtration, clean oil leaves the filter housing by an outlet port, also located in a lower part of the filter housing and below the filter element.

Generally, such types of filter assemblies include a drain port for draining oil from the assembly for replacement of the filter element. It is known to have a valve covering the drain port and which is opened on removal of the filter element from the housing.

Another known type of filter assembly includes an integral oil cooler for cooling incoming oil prior to filtration.

The present invention seeks to provide an improved filter assembly.

According to an aspect of the present invention, there is provided a filter assembly comprising a filter housing including a drain port and a first threaded engaging surface; and an end cap including a second threaded engaging surface engageable with the first threaded engaging surface so as to secure the end cap to the filter housing and an elongate spigot integral with the end cap, wherein when the end cap is secured to the filter housing, the spigot extends into at least part of the drain port so as to close the drain port.

The design of end cap and spigot can provide a reliable sealing of the oil filter chamber and convenient and automatic oil drainage on release of the end cap.

5 Preferably, the spigot is capable of sliding into at least part of the drain port. In this manner, the end of the spigot acts as a valve, avoiding the need to have a specific valve for the drain port.

10 In the preferred embodiment, there is provided a filter element including a filter medium and support means for supporting the filter medium within the filter housing.

15 Advantageously, there may be provided a second drain port including an aperture in the filter housing, wherein the support means is operative to close the second drain port when the filter element is disposed in the filter housing. The second drain port may be provided to drain oil from parts of the filter housing which cannot be drained through the first
20 drain port. The support means of the filter element can act as a valve to the second drain port, thereby avoiding the need for a separate valve element for this drain port.

25 Preferably, the support means includes a central support tube operative to support the filter medium and to close the second drain port. It may be possible to use a conventional support tube in dependence upon the design and location of the second drain port, thereby avoiding the need for any new or
30 modified components.

 Alternatively, the support means includes a support disc operative to support the filter medium and to close the second drain port. Where a thin filter support tube is used, such a disc may be useful
35 also for supporting the filter medium.

Preferably, the support means is operative to secure the filter element to the end cap. In this manner, when the end cap is removed from the filter housing, the filter element is removed simultaneously. Furthermore, the end cap can be used both as a carrier for the filter element and as a cup for receiving oil dripping from the old filter element.

The end cap may comprise a support wall, the support means being operative to secure the filter element to the support wall with an interference fit. It has been found that such an arrangement can provide adequate fixing of the filter element to the end cap without the need for any other fittings.

According to another aspect of the present invention, there is provided a filter assembly comprising a filter housing including a drain port, an end cap securable to the filter housing and a filter element including an annular filter medium supported around annular support means within the filter housing, the support means contacting the drain port so as to close the drain port when the filter element is disposed in the filter housing.

According to another aspect of the present invention, there is provided a combined oil filter and cooler assembly comprising a filter assembly as herein specified.

An embodiment of the present invention is described below, by way of illustration only, with reference to the accompanying drawings, in which:

Figure 1 is a side elevational view in cross-section of an embodiment of filter assembly; and

Figure 2 is a side elevational view, in cross-section, opposite to the view of Figure 1 of part of the oil filter assembly.

Referring to Figure 1, the embodiment of filter assembly for filtering oil in a vehicle engine shown includes an oil filter 10 and oil cooler 12 within the same cast housing 14. The housing 14 is
5 made of a metal, in this embodiment aluminium.

The assembly includes an oil inlet for receiving oil from the vehicle engine and a plurality of outlets including a principal outlet 18 through which cooled and filtered oil leaves the filter
10 assembly and rejoins the vehicle oil circuit.

The housing 14 of this embodiment is designed to be located in a vehicle in the general orientation shown, that is with the filter 10 above the oil inlet and outlet 18 and, in the example shown,
15 above the cooler 12.

The oil cooler 12 is of known type and includes a cooler element 20 of generally rectangular cuboid shape and having a plurality of substantially parallel vanes 22 within which cooling fluid passes and around which hot oil is fed for cooling thereof.
20 The cooler element 20 includes an inlet conduit 24 coupled to a header of known form located at one end of the vanes 22 for feeding cooling fluid to the vanes 22. An outlet conduit 26 (Figure 2) similar to the
25 inlet conduit 24 is located at the opposite end of the vanes 22 and collects cooling fluid from the vanes 22 for transfer out of the filter assembly.

Typically, the cooling fluid is water.

At the inlet end of the cooler element 20,
30 the cooler housing includes an oil inlet port (not shown) for receiving hot oil from the engine. An oil outlet port (not shown) is located at the cooler element outlet end and communicates directly with the chamber 28 of the oil filter 10, such that in use
35 cooled oil passes to the filter 10 for filtration.

The filter 10 includes a filter housing 30 formed as part of the assembly housing 14. The filter housing 30 is generally cylindrical and is substantially circular when viewed along its axis 32.

5 A threaded inner annular surface 34 is provided at the open end of the filter housing 30 and engages a complementary threaded outer surface 34 of an end cap 40.

The end cap 40 is also made of a metal, preferably aluminium or an alternative polymer material, preferably nylon. It includes an annular groove proximate its threaded surface 36 for receiving an O-ring seal 42 and an annular rib 44 for limiting the amount by which the end cap 40 can be tightened onto the filter housing 30. The outer surface of the end cap may be indexed or otherwise shaped to receive a tightening tool.

An elongate spigot 46, which is substantially cylindrical in axial cross-section, is integral with the end cap 40 and extends from the centre thereof beyond the threaded surface 36. The free end 48 of the spigot 46 is slightly smaller in axial cross-sectional diameter than the remainder thereof and has a tapered tip 50 to facilitate fitting of the end cap 40 in the filter housing 30. Proximate its tip 50, the spigot 46 includes an annular groove which houses an O-ring seal 52.

A substantially circular annular support 54 is provided in the end cap 40 substantially co-axially with the spigot 46. The support 54 includes a portion of reduced outer diameter which forms on the support 54 a shoulder 56 against which filter element 16 abuts. The portion of reduced outer diameter is tapered at its free end for facilitating the fitting of the filter element 16 on the support 54.

The filter housing 30 includes a first drain port 60 located at a lower end of a tubular wall 62 which extends into the filter chamber 28 and is coupled to the vehicle oil circuit. When the end cap 40 is fitted to the filter housing 30, the free end 48 of the spigot 46 fits within the first drain port 60 so as to close it. The O-ring seal 52 prevents any leakage between the spigot 46 and the walls of the drain port 60.

10 The base of the tubular wall 62 includes two steps, a first upper step 64 adjacent the tubular wall 62 and a second lower step 66 having an outer diameter greater than the outer diameter of the upper step 64. The lower step 66 extends to the base of the filter housing 30.

15 A secondary drain port 68 (Figure 2) extends into the lower step 66 to an aperture at the shoulder of the lower step 66 which couples the upper and lower steps 64, 66 together. The secondary drain port 68 is coupled to an oil outlet 70 which communicates with the vehicle oil circuit.

25 The filter element 16 consists of a pleated filter paper of known type. The pleats extend in the longitudinal direction of the filter element 16. Each pleat has one pleat edge attached to a central support tube 72 and an opposite pleat edge forming part of the radial outer periphery of the filter element 16.

30 In the preferred embodiment, the central support tube 72 has a thickness substantially the same as the width of the shoulder of the lower step 66 and an inner diameter substantially the same as the outer diameter of the upper step 64. In this manner, the central support tube 72 is supported by the upper step 64 and covers the shoulder of the lower step 66, thereby also covering the secondary drain port 68.

In another embodiment, the central support tube of the filter element 16 is of smaller thickness than the tube shown in Figure 1. A support disc 74 shown in dotted outline in Figure 1 is coupled to the support tube and extends to the radial outer perimeter of the filter element 16. A lip is formed on the support disc 74 and extends over the end of the filter paper. In this embodiment, the central support tube and the support disc together block the secondary drain port 68.

In both of the above embodiments, the central support tube 16 has formed therein a plurality of apertures 78 which extend along its length.

The inner diameter of the central support tube 72 is a tight fit on the reduced diameter portion of the support 54.

As will be apparent, during normal operation, hot oil from the engine is cooled through the cooler 12 prior to passing to the filter 10. Cooled oil passes from the cooler 12 through a conduit (not shown) which opens into the base of the filter housing 30, so as to reach the space between the cylindrical wall of the filter housing 30 and the filter element 16. The oil is then filtered, by means of pressure produced by the vehicle oil circuit, through the filter paper and passed through the apertures 78 in the central support tube 72. From the interior of the support tube 72, the oil passes into the tubular wall 62 of the filter housing 30 and to the principal outlet 18 to rejoin the vehicle oil circuit.

During normal operation, the spigot 46 blocks the first drain port 60, while the central support tube 72 and, where appropriate, the support disc 74, block the second drain port 68.

When it is desired to change the oil filter 16, the end cap 40 is unscrewed, with the aid of a tool if necessary, so as to draw the end cap 40 gradually out of the filter housing 30. As this
5 occurs, the filter element 16 is carried with the end cap 40, thereby gradually uncovering the second drain port 68 to allow oil still within the oil filter 10 to begin draining.

Upon further unscrewing of the end cap 40,
10 the end of the spigot 46 is drawn out of the first drain port 60, thereby opening this drain port to drain oil remaining within the area bounded by the tubular wall 62.

The relative timing of the opening of the
15 two drain ports 60, 68 can be adjusted by adjusting the length of the spigot 46, in particular to adjust the amount by which the spigot 46 extends into the first drain port 60.

Thus, drainage of oil from the oil filter
20 housing 30 is automatic. Furthermore, since the filter element 16 is held on the end cap 40 as a result of the interference fit of the central support tube 72 on the annular support 54, it is not necessary to handle the dirty oil filter itself. On release of
25 the end cap 40 from the filter housing 30, it can be inverted so as to act as a convenient filter holder and cup for receiving dripping oil from the filter element 16. The filter element 16 can then be disposed of and a new filter element 16 fitted to the
30 annular support 54 prior to refitting the end cap 40 onto the filter housing 30.

As will be apparent from the above, the spigot 46 and the central support tube 72 or the combination of the support tube 72 and support disc 74

act as valves for the drain ports 60, 68. As a result, no separate valving units are required.

In some embodiments, the support disc 74 may by itself block the second drain port 68, for example
5 in cases where a very thin central support tube 72 is used.

Claims:

1. A filter assembly comprising a filter housing including a drain port and a first threaded engaging surface; and an end cap including a second threaded engaging surface engageable with the first threaded engaging surface so as to secure the end cap to the filter housing and an elongate spigot integral with the end cap, wherein when the end cap is secured to the filter housing, the spigot extends into at least part of the drain port so as to close the drain port.
2. A filter assembly according to claim 1, wherein the spigot is slidable into the drain port.
3. A filter assembly according to claim 1 or 2, comprising a filter element including a filter medium and support means for supporting the filter medium within the filter housing.
4. A filter assembly according to claim 3, comprising a second drain port including an aperture in the filter housing, wherein the support means is operative to close the second drain port when the filter element is disposed in the filter housing.
5. A filter assembly according to claim 4, wherein the support means includes a central support tube operative to support the filter medium and to close the second drain port.
6. A filter assembly according to claim 4, wherein the support means includes a support disc operative to support the filter medium and to close the second drain port.
7. A filter assembly according to any one of claims 3 to 6, wherein the support means is operative to secure the filter element to the end cap.
8. A filter assembly according to claim 7, wherein the end cap comprises a support wall, the

support means being operative to secure the filter element to the support wall with an interference fit.

5 9. A filter assembly comprising a filter housing including a drain port, an end cap securable to the filter housing and a filter element including an annular filter medium supported around annular support means within the filter housing, the support means contacting the drain port so as to close the drain port when the filter element is disposed in the
10 filter housing.

10. A filter assembly substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

15 11. A combined oil filter and cooler assembly comprising a filter assembly according to any preceding claim.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
 GB 9502822.1

Relevant Technical Fields

- (i) UK CI (Ed.N) B1D (DNED, DNRF)
 (ii) Int CI (Ed.6) B01D 35/147, 35/153; F01M 1/10; 11/03

Search Examiner
 MR G BRIDGES

Date of completion of Search
 19 APRIL 1995

Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE: WPI

Documents considered relevant following a search in respect of Claims :-
 1-8, 10, 11

Categories of documents

- | | |
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| <p>X: Document indicating lack of novelty or of inventive step.</p> <p>Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.</p> <p>A: Document indicating technological background and/or state of the art.</p> | <p>P: Document published on or after the declared priority date but before the filing date of the present application.</p> <p>E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.</p> <p>&: Member of the same patent family; corresponding document.</p> |
|--|---|

Category	Identity of document and relevant passages	Relevant to claim(s)
X	GB 1502469 A (DAIMLER-BENZ AG) see eg page 2 lines 90-98	1-3
X	US 5087364 A (CARTER-HOFFMAN) see description of the drawings	1-3, 7

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).



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**The
Patent
Office**

Application No: GB 9502822.1
Claims searched: 9

Examiner: Dr. A.J.Rudge
Date of search: 25 May 1995

Patent Office
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0633-814000

Patents Act 1977
Further Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK Cl (Ed.N): B1D (DNED,DNRF)
Int Cl (Ed.6): B01D-035/147;035/153 F01M-001/10;011/03
Other: online databases: wpi,claims

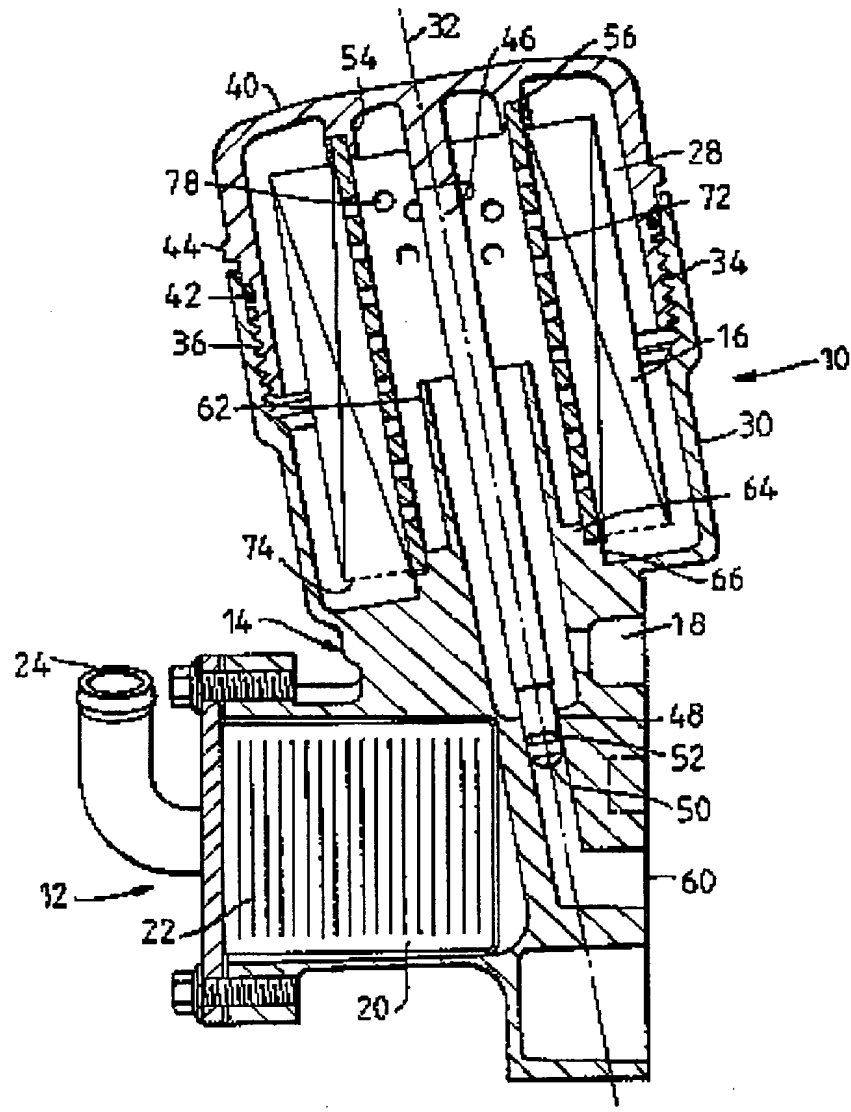
Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB2162079A (Filterwerk) - see Fig and page 3,lines 20 et seq.	9
X	US5098559 (Filterwerk) - see esp. Fig.1 and col.2,lines 5 et seq.	9
X	US4906365 (Hengst) - see Fig.1 and col.3 lines 13 et seq	9
X	GB1502469 (Daimler-Benz) -see claim 5	9

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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Fig. 1.



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Fig. 2.

